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Agaña, the metropolis of the island, achieved its pre-eminence by reason of its abundant water supply, although there is only a roadstead in front of it, with unsafe anchorage. San Luis d'Apra is the largest harbour of the island, with a number of small towns along its extensive shores. Port Tarofoto, on the southeast coast, is the only harbour next to San Luis which can receive vessels at all seasons of the year. Port Ynarajan and Agfayan Bay have good anchorage, and are of some importance in the *coprá* trade. Umata was once important commercially; but, since its destruction by an earthquake in 1849, Agaña has forged far ahead of it.

The towns of the west coast are connected by paths or roads. The road from Agaña to the north passes through an especially fertile country; and there are two passageways across the island—a fairly good road from Agaña to Pago and a poor path from Apra, diagonally across to Ynarajan.

The gentle Chamorros, the aboriginal inhabitants, have heartily welcomed the advent of the Americans. They are lighter in colour than the Filipinos, fully clad, subject to few diseases, and cheerful in disposition. They procure their food from the farms or the sea, live in very well-built houses, many of them of stone, and manufacture at home most of the things they need. Many of them are half-breeds, their fathers being American and British whalers, whose visits are now very rare. The influence of the Roman Catholic missionaries, who have lived among them for generations, has been favourable; and the Caroline Islanders, about 100 of whom came to the island as farm labourers and now till their own little farms, are far behind the natives of Guam in civilization.

TOPOGRAPHIC SURVEY OF THE UNITED STATES.

During the twenty-three years' existence of the Geological Survey it has mapped thirty-two per cent. of the area of the United States, exclusive of Alaska; or, in other words, there have been mapped to date 967,000 square miles of the country, on scales ranging from four miles to an inch, two miles to an inch, and one mile to an inch, up to large-scale detailed surveys for special areas.

During the past season there were in the field over ninety separate parties. These were working in thirty-four different States and Territories, including Alaska, and comprised a force which included eighty-two topographers, ten other party chiefs, and about

three hundred temporary assistants. This force mapped, in round numbers, 20,000 square miles, on the scale of about two miles to an inch, with relief, shown by contours, having intervals varying between twenty and one hundred feet; and 17,000 square miles on the scale of one mile or larger.

While nearly one-third of the area of the country has been mapped, the progress is apparently at the rate of but one per cent. of the country per annum, at which rate it would require nearly eighty years yet to complete the map of the United States. On the other hand, the absolute amount of work accomplished is great; for thirty-seven thousand square miles make an area as great as that of Indiana, or of South Carolina and Connecticut together. As compared with the areas of European countries, it would be equivalent to mapping annually Portugal, or Belgium, Denmark, and the Netherlands combined.

During the year the results in the more important sections of the country were as follows: In Maine, 215 square miles were mapped on the upper Kennebec, and a complete topographic survey, accompanied by careful spirit levels, was made of the entire Kennebec River to the Moosehead Lake outlet. In New Hampshire an equal area was mapped in the neighbourhood of Manchester and Nashua; in Vermont, a like area between Middlebury and Vergennes.

In New York over 2,500 square miles were mapped, chiefly in the Adirondacks, Western New York, the Catskills, and on Long Island, where the entire survey was completed, and the results will soon be engraved for final publication. In the neighbourhood of Plainfield, Morristown, Somerville, and High Bridge, New Jersey, the old State survey maps were revised to bring the culture, such as roads, houses, etc., up to date over an area of about 800 square miles.

In Pennsylvania an area approximating 800 square miles was mapped in the neighbourhood of Johnstown and in and about Pittsburgh. The latter map was made on the large scale of two thousand feet to one inch, which permitted of showing every house, factory and other building, street and trolley lines, and resulted in the completion of the first connected map of that region. In Ohio about 3,000 square miles were completed, including particularly areas about Ashtabula, Akron, Kent, Marion, Hamilton, Athens, etc. In West Virginia an area of 1,800 square miles was mapped, chiefly in the northwestern portion of the State, including the region in which coal, oil, and other mineral resources are being developed.

In North Carolina and Georgia surveying was extended in each case over about 600 square miles. In Tennessee nearly 1,000 square miles were mapped southwest of Nashville; and in Kentucky an equal area in the Blue Grass country south of Lexington and in the mountains near Middleboro. In Louisiana an area of nearly 1,000 square miles is still under survey immediately north of Baton Rouge.

In the Central States about 500 square miles were mapped in Indiana near Evansville and in Iowa near Decorah; in Wisconsin, about 500 square miles near Richland Center, and an equal area near Racine and Koshkonong; in Michigan, 800 square miles between Ann Arbor and Detroit. About Independence, Kansas, about 1,000 square miles were mapped, and 300 square miles in the neighbourhood of Bonne Terre, Missouri. In Arkansas 500 square miles were mapped immediately west of Eureka Springs. A resurvey on the large scale of 2,000 feet to an inch was completed of an area of 500 square miles about the city of St. Louis. The publication of this is to be pushed with all vigour, with a view to completing it in time for printing and distribution at the World's Fair in 1904.

In the Far West a large amount of work was in progress in the vicinity of Circle City and the Nome peninsula, Alaska. In Arizona detailed mapping of a portion of the Grand Cañon of the Colorado is in progress, besides the survey of about 250 square miles near Tucson and of 1,000 square miles near Nogales. In Colorado topographic surveying of 150 square miles was completed near Georgetown, and large-scale special maps for the study of mineral resources were made in the neighbourhood of Cripple Creek and Lake City. In Utah 100 square miles were mapped in the Uinta Mountains, and a large-scale special map made near Cottonwood, on the summit of the Wasatch Mountains. In Texas an area of 500 square miles was mapped in the Chicos Mountains. In Montana about 300 square miles were mapped in Flatwillow County. In Wyoming in the neighbourhood of Laramie and Sherman there was mapped an area of about 1,300 square miles. In Oregon about 500 square miles of Union County were completely surveyed. In Washington the survey was in progress, or was completed, of about 2,600 square miles in the neighbourhood of Mt. Adams, Chapaca, Oakdale, and Okanogan.

In the State of California there were mapped about 1,500 square miles in Santa Barbara, San Luis Obispo, Tulare, and Fresno Counties. In this State there were also made special large-scale sur-

veys for study of mineral resources in Shasta County, about Bully Hill and Little Backbone. Mapping in the Sacramento and San Joaquin valleys will be continued throughout the larger part of the winter.

No unusual topographic features or unknown regions were developed by the surveys of the past season. Some interesting forms were mapped, and facts of interest to the geographer and the geologist will be made evident by the resulting atlases, notably in the detailed surveys about Bright Angel, the tourists' region of the Grand Cañon of the Colorado. The intricate forms resulting from the erosion of this gorge are beautifully portrayed on the map, and give quite a different idea of the topography as compared with that in the earlier exploratory maps.

Of almost equal interest are the maps of the southern shore of Lake Erie and about Detroit, because of the light they throw on the various stages of the Great Lakes as depicted in the outlines of the old beaches.

The map of the vicinity of Pittsburg is one of the most interesting ever made. The topography shows a highly-eroded plateau, and the various rivers are bordered by steep bluffs, upon the sides and slopes of which have been built a series of cities which for density of habitation and congestion of streets, buildings, and railroads is hardly paralleled anywhere, when the abruptness of the mountain slopes is taken into consideration.

In addition to the topographic mapping described a large amount of geodetic control, both by primary triangulation and primary traverse, was extended throughout various unmapped areas of the country. This is to serve as a basis upon which to develop topographic surveying. It consisted in determining by geodetic methods the astronomic positions of important points, as mountain summits, church spires, etc.

In the East a belt of triangulation was extended from near Burlington, Vermont, to the Canadian line. In New York primary traverse was run to control scattered areas between Rochester and Buffalo and east of Oswego. In Pennsylvania similar control was extended to the eastward of Philadelphia and in the northwestern corner of the State. In Ohio similar control was extended along the western State boundary throughout half its length to the northwestern corner of the State, as well as scattered areas elsewhere. In West Virginia primary triangulation was extended between Charleston and Elizabeth. In Kentucky primary traverse was extended southeast of Owensville; in North Dakota, over

an area of about 2,000 square miles between Fargo and Grand Forks.

In the western United States more extensive areas were controlled by primary triangulation. In Montana a belt of triangulation was extended down the Milk River for over 100 miles from Fort Assinniboine. In Wyoming a belt was extended across the State from north to south between the neighbourhoods of Laramie and Buffalo; in eastern Washington, from North Yakima through Yakima, Douglas, and Kittitas Counties to the international boundary. In eastern and central Oregon large areas were similarly controlled in Grant, Harney, and Malheur Counties, and in the famous Modoc lava-beds country. In Arizona a belt of triangulation was extended from the neighbourhood of Florence, *via* Tucson, to the Mexican boundary near Nogales.

Throughout the various regions in which topographic mapping was in progress there were run about 17,000 miles of very accurate primary levels, and 25,000 linear miles of secondary levels of less accuracy, for the location of contour lines upon the topographic maps. Some precise levelling was extended near the Pacific coast in the upper Sacramento valley, with a view to reducing the spirit-levelling to mean sea-level datum. In connection with all this spirit-levelling many thousands of bench-marks were established, which will serve as reference points for engineers and others who may have to make use of careful levels in connection with their work.

H. M. W.

THE PANAMA CANAL IN ITS COMMERCIAL ASPECTS.

BY

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As the beginning of the actual work of constructing an Isthmian canal seems to be close at hand, the present is an opportune time for making a careful study of the commercial aspects of the great waterway. The purpose of the present paper is to consider the effects which the canal will have on commercial routes and the volume of traffic that will make use of the waterway at the commencement and during the early years of its operation.

The use that will be made of the canal will depend upon the